# Technology Opportunity

## Optical Diagnostics of Biological Fluids and Tissues

The National Aeronautics and Space Administration (NASA) seeks to transfer NASA-developed new technology for studying and characterizing various biological fluids.

### Potential Commercial Uses

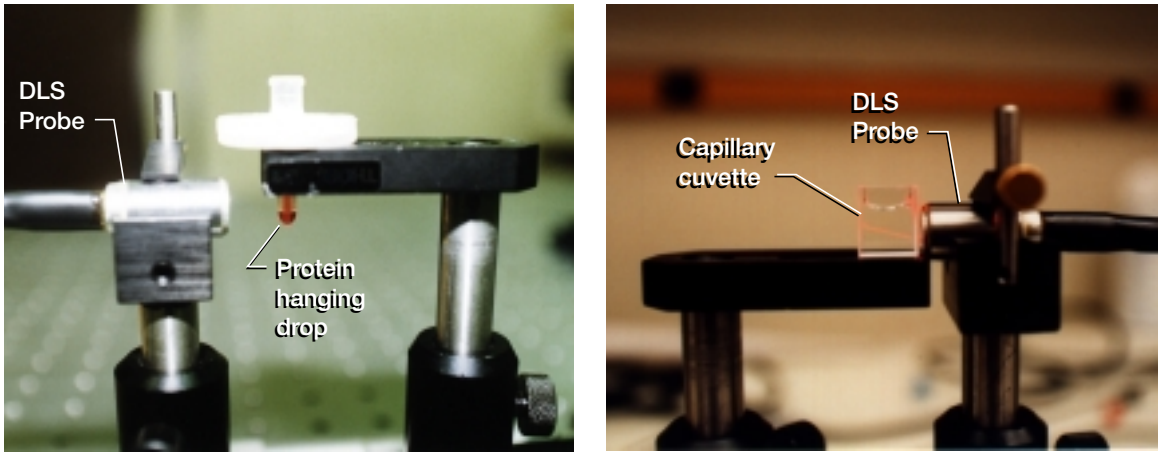
- Characterization of protein solutions
- Characterization of blood
- Characterization of viruses, spermatozoa, and synovial fluids (vitreous humor and fluids in joints)
- Analysis of skin and tissue

### Benefits

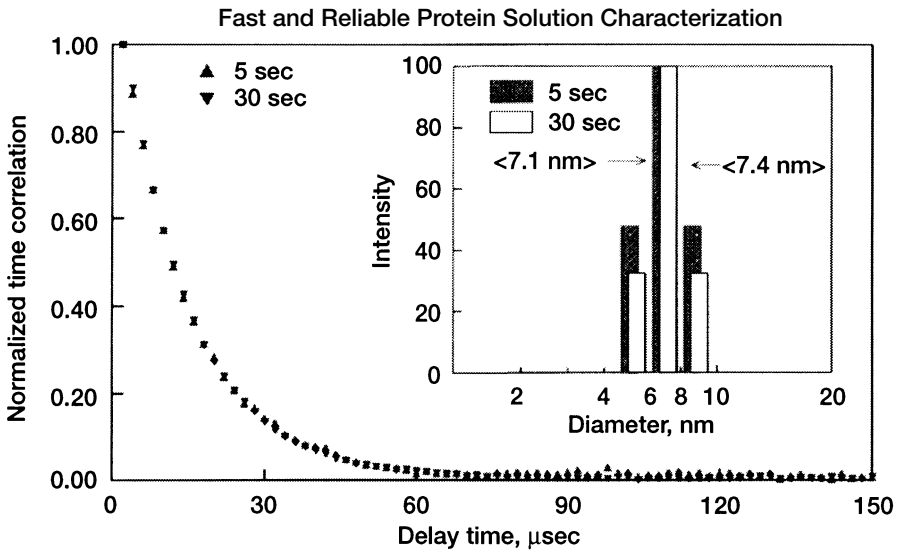
- Compact, rugged, and free of optical alignment
- Accurate and reliable characterization of biological fluids
- Point-and-shoot operation—portable and easy to use
- Flexible in-situ and in-vivo applications
- Very low laser power—10 nW to 3 mW
- Fast measurement time—5 to 30 sec
- Adaptable—video imaging system can be added for extended particle size (greater than a few micrometers)

### The Technology

The characterization of biological fluids, especially in vivo and in situ, offers a formidable challenge to the designers of optical diagnostics instrumentation. Biological fluids often contain a wide range of particulate matter. For example, the human body contains approximately 150,000 different proteins. Several optical diagnostic techniques are available, including dynamic light scattering (DLS). DLS is routinely used to characterize dilute macromolecular solutions in an effective size range of 3 nm to 3 μm. In general, however, DLS has not gained wide acceptance in biological and biochemical laboratories except in some special cases, because several factors limit the application of conventional DLS measurements. For example, conventional DLS




Point-and-shoot operation for particle-sizing applications.




Comparison of 5- and 30-sec experiments on 2 percent protein (BSA) solution with a laser power of 1.0 mW; 5-sec experiment determines particle sizes as reliably and accurately as 30-sec experiment.

systems are large and bulky, and they require precise optical alignment and vibration isolation. Also, the poor sensitivity of conventional systems necessitates longer experiment durations and the use of a laser with higher power, requiring an extensive measure of safety precaution. In an effort to alleviate these problems, a fiber-optic DLS probe was developed at the NASA Glenn Research Center to study various biological fluids.

Our compact system exploits the principles of DLS and offers a fast (within a few seconds) means of quantitatively and noninvasively characterizing various biological fluids. In addition to DLS capability, the probe can be used for single-angle static light-scattering measurements. It uses extremely low levels of laser power and essentially eliminates the usual problems associated with optical alignment, poor signal-to-noise ratios, and vibration isolation. The compact probe also is equipped with a miniaturized microscope for visualizing macroscopic particles. This new optical diagnostic system makes possible the exploration of new applications in protein crystallization, the development of new pharmaceutics, and noninvasive skin and tissue analysis.

## Options for Commercialization

A fiber-optic probe has been developed at NASA Glenn, and a patent application has been filed. Some companies have expressed interest in commercializing the probe.

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## Key Words

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Fiber optics

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